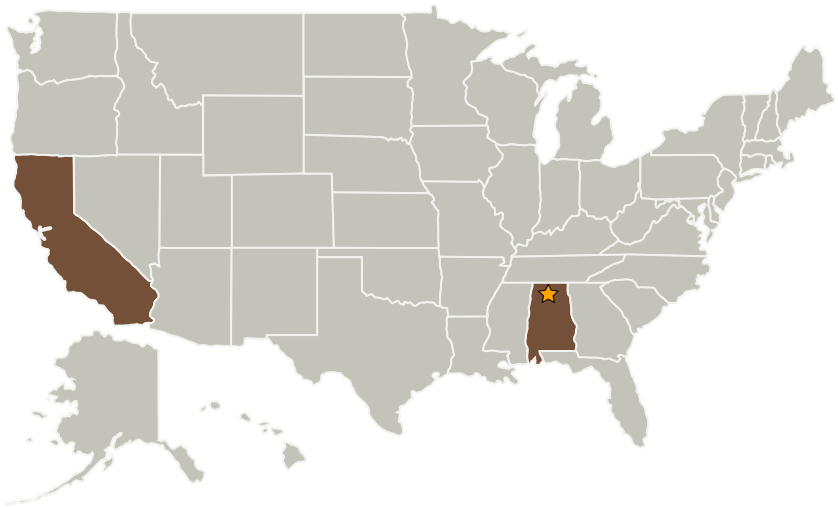
Holographic Optical Element-Based Laser Diode Source System for Direct Metal Deposition in Space, Phase II

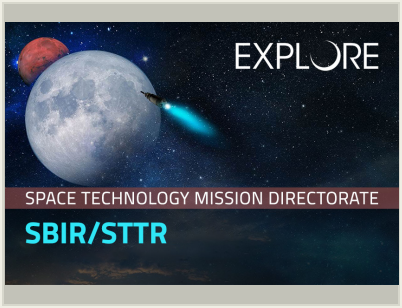
Completed Technology Project (2004 - 2006)

Project Introduction

To meet the challenges of rapid prototyping, direct hardware fabrication, and on-the-spot repairs on the ground and on NASA space platforms, Physical Optics Corporation (POC) proposed a new Holographic Optical Element-Based Laser Diode Source (HOELDS) system for direct metal deposition (DMD). HOELDS uniquely combines multiple high-power laser diode bars with holographic optical elements, efficient thermal management and innovative focusing optics to achieve a 600 W, 100-micron focused spot for DMD materials processing. The 7-kilogram, 0.1 cubic meter HOELDS system will be ten times as energy efficient as current 1000 kilogram, 20 cubic meter DMD systems, making in-space DMD processing possible for the first time. HOELDS can process aluminum, which is extremely difficult for state-of-the art DMD systems. In Phase I, POC developed a preliminary HOELDS system, theoretical analysis, computer simulation, and component specifications leading to a proof-of-concept prototype. Melting of lead-tin solder with this prototype was demonstrated at NASA Marshall Space Center. The Phase II effort will optimize the system design, optimize fabrication of the holographic optical elements, and scale up the system into a compact high-power HOELDS system prototype capable of DMD. The prototype system will be performance tested for in-space DMD, and will be space qualified.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Marshall Space Flight Center (MSFC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Marshall Space Flight Center(MSFC)	Lead Organization	NASA Center	Huntsville, Alabama
Physical Optics Corporation	Supporting Organization	Industry	Torrance, California

Primary U.S. Work Locations	
Alabama	California

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.1 In-space Propellant Storage & Utilization